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CHEMICAL TREATMENT OF SURFACES IMPROVES GLUE JOINTS IN CERTAIN WOODS[1]

In tests at the Forest Products Laboratory a solution of caustic soda proved effective in reducing the tendency to "starved" animal-glue joints in woods in which this type of defective joint is common. Caustic soda or lime water treatments also strengthened casein-glue joints in woods that ordinarily are joined with this glue with some difficulty.

The caustic soda solution consisted of 10 parts by weight of caustic soda and 90 parts of water. The treatment consisted of brushing the solution onto the surfaces to be joined. After about 10 minutes the surfaces were wiped with a cloth to remove any excess solution or dissolved material and allowed to dry before being glued.

Tests of Animal-glue Joints

The results of the tests on treated wood joined with animal glue under starved-joint conditions are indicated in table 1 in such a way as to show whether the treated joints gave higher or lower test results -- with respect to strength in shear and percentage of wood failure -- than joints glued without preliminary treatment under both good and starved-joint conditions.

The entire group of treated joints -- 13 species -- showed 51 percent greater average strength in shear than the untreated joints of the same species glued under starved-joint conditions, and 97 percent more wood failure.

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[1] In the case of most of the native American woods the trouble and expense of treating joints with caustic soda is not justified, as joints as strong as the wood can be obtained in the majority of species through the use of proper gluing conditions.

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In the case of the caustic-treated black walnut listed in table 1, although the strength values were less than those for untreated wood, the improvement in the starved-joint condition is indicated by the increase in the percentage of wood failure. With black walnut the lower strength of the treated joints was apparently due to poorer quality wood.

Tests of Casein-glue Joints

The results of tests of caustic-treated casein-glue joints are presented in table 2. This table is similar to table 1 except that starved joints do not enter the comparison of treated and untreated joints.

Tests on caustic-treated casein-glue joints in osage orange, made independently of the tests on which table 2 is based, gave striking results. Osage orange contains a large amount of extractives and is one of the most difficult of all woods to join with casein glue. When this species was glued untreated, practically no adhesion at all occurred; the joints showed an average strength in shear of only 294 pounds per square inch and no wood failure. When it was treated with caustic soda, however, the average joint strength was over 3,000 pounds per square inch, and wood failure was 35 percent.

Lime water, ammonia, benzol, hydrochloric acid, and bleaching powder (chloride of lime) were other materials tested at the same time as the caustic soda. Hydrated lime (10 parts added to 90 parts of water) gave slightly better results than caustic soda when used as a surface treatment for hickory, red gum, and black cherry joined with casein glue. Of the other chemicals named above, some gave encouraging results on one or two species, but the results in general were not sufficiently consistent to warrant discussion in this note.

Table 1. --Effect of caustic soda on animal-glue joints

(Wood treated with caustic soda and glued under starved-joint conditions)

Species of wood	Average strength	Average wood failure
	Lbs. per sq. in.	Percent
Basswood	++	+
Yellow birch	++	+
Black cherry	++	++
Red gum heart	++	+
Red gum sap	++	+
Sugar maple	++	++
Red oak	++	+
White oak	++	++
Osage-orange	+	+
Northern white pine	++	-
Southern yellow pine	++	+
Yellow poplar	++	++
Black walnut	-	++

\+ = More than value for untreated wood glued under starved-joint conditions.

++ = More than value for untreated wood glued under either starved-joint conditions or good gluing conditions.

\- = Less than value for untreated wood glued under either starved-joint or good gluing conditions.

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Table 2. --Effect of caustic soda on casein-glue joints

(Wood treated with caustic soda and glued under normal conditions)

Species of wood	Average strength	Average wood failure
	Lbs. per sq. in.	Percent
Basswood	+	+
Red gum heart	+	-
Red gum sap	+	+
Hickory	+	+
White oak	-	-[1]
White pine	+	-
Redwood	+	+

[1] Difference insignificant.

+ = More than value for untreated wood glued under same conditions.
- = Less than value for untreated wood glued under same conditions.